

## CLAIMS

We claim:

1. Apparatus for warming a catheter, comprising:  
a pump unit, comprising:  
5 a non-disposable pump drive; and  
a disposable pump, removably couplable to the pump drive,  
comprising an interior volume and an exterior volume between which liquid is  
transferred uni-directionally on operation of the pump drive, and a ventilation  
unit configured to allow gas passage between the pump and atmospheric  
10 surroundings of the pump while preventing passage of the liquid  
therebetween;  
a heating unit, comprising:  
a non-disposable section comprising a heating element and a  
temperature sensor; and  
15 a disposable heated section, removably couplable to the non-disposable  
section, comprising an inlet and an outlet orifice and configured to transfer the  
liquid therebetween, and to maintain the liquid in good thermal contact with  
the heating element and the temperature sensor when coupled to the non-  
disposable section; and  
20 disposable tubing coupling the disposable pump, the disposable heated  
section, and the catheter, so that the disposable pump, the disposable heated section,  
and the catheter comprise a closed circuit for the liquid.
2. Apparatus according to claim 1, wherein the non-disposable pump drive  
comprises an eccentric coupled to oscillate a connecting rod, and wherein the  
25 disposable pump comprises a flexible diaphragm which is fixedly attached to the  
disposable pump and which is configured to removably mate with the connecting rod.
3. Apparatus according to claim 2, wherein the non-disposable pump drive  
comprises a housing which retains the eccentric and the connecting rod, and which is  
configured to fixedly retain the disposable pump when the pump is removably  
30 coupled to the pump drive.
4. Apparatus according claim 1, wherein the interior volume comprises a  
dividing element which constrains the liquid to exit the pump and which is adapted to

maintain an air pocket in the pump so as to smooth pulsations of the liquid.

5. Apparatus according to claim 1, wherein the ventilation unit comprises a labyrinth groove which enables the gas passage while preventing the passage of the liquid.

5 6. Apparatus according to claim 1, wherein the disposable heated section comprises a tube which is configured to direct flow of the liquid therein so as to maintain the liquid in good thermal contact with the temperature sensor.

7. Apparatus according to claim 6, wherein the tube is implemented from heat-insulating material, so as to reduce heat transfer between the liquid in the tube and the  
10 liquid external to the tube.

8. Apparatus according to claim 1, wherein the disposable heated section comprises fins which are configured to extend a path followed by the liquid between the inlet and the outlet orifice, and wherein the fins increase the heat transfer between the heating element and the liquid.

15 9. A method for warming a catheter, comprising:

removably coupling a disposable pump to a non-disposable pump drive, the disposable pump comprising an interior volume and an exterior volume between which liquid is transferred uni-directionally on operation of the pump drive, and a ventilation unit configured to allow gas passage  
20 between the pump and atmospheric surroundings of the pump while preventing passage of the liquid therebetween;

removably coupling a disposable heated section to a non-disposable section comprising a heating element and a temperature sensor, the disposable heated section comprising an inlet and an outlet orifice and configured to  
25 transfer the liquid therebetween, and to maintain the liquid in good thermal contact with the heating element and the temperature sensor when coupled to the non-disposable section; and

coupling the disposable pump, the disposable heated section, and the catheter with disposable tubing, so that the disposable pump, the disposable heated section,  
30 and the catheter comprise a closed circuit for the liquid.

10. The method according to claim 9, wherein the non-disposable pump drive comprises an eccentric coupled to oscillate a connecting rod, and wherein the

disposable pump comprises a flexible diaphragm which is fixedly attached to the disposable pump and which is configured to removably mate with the connecting rod.

11. The method according to claim 10, wherein the non-disposable pump drive comprises a housing which retains the eccentric and the connecting rod, and which is  
5 configured to fixedly retain the disposable pump when the pump is removably coupled to the pump drive.

12. The method according claim 9, wherein the interior volume comprises a dividing element which constrains the liquid to exit the pump and which is adapted to maintain an air pocket in the pump so as to smooth pulsations of the liquid.

10 13. The method according to claim 9, wherein the ventilation unit comprises a labyrinth groove which enables the gas passage while preventing the passage of the liquid.

14. The method according to claim 9, wherein the disposable heated section comprises a tube which is configured to direct flow of the liquid therein so as to  
15 maintain the liquid in good thermal contact with the temperature sensor.

15. The method according to claim 14, wherein the tube is implemented from heat-insulating material, so as to reduce heat transfer between the liquid in the tube and the liquid external to the tube.

16. The method according to claim 9, wherein the disposable heated section  
20 comprises fins which are configured to extend a path followed by the liquid between the inlet and the outlet orifice, and wherein the fins increase the heat transfer between the heating element and the liquid.